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MODERN STORE USES GAS

EXTRA AID FOR STOVING, DRYING

LOOKING AROUND

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Editorial

Gas and the motor car trade

THE fact that the popularity of gas in industry is steadily rising is well-known, but nowhere is this popularity more marked than in the area of the West Midlands Gas Board. Here, according to the last annual report, sales of gas to industry rose by 9.6% to the remarkable total of 181½ mill. therms—an all-time record.

The reason for this steadily increasing demand in the face of tremendous competition is not difficult to determine. It stems from the fact that although for some purposes gas is not the cheapest fuel, industry chooses it because of the unique service with which the West Midlands Gas Board backs up its industrial sales. Like the other 11 boards, the West Midlands Board realises that utter reliability of supply and quality, coupled with know-how in the shape of a specialised and highly skilled department capable of developing processes and equipment on behalf of its customers, is often more important than a possible fractional price advantage.

Of course, the Midlands boasts an astonishingly wide range of industry, and from a gas board's point of view this is a good thing, resulting in a healthily balanced load. But in fact the West Midlands Gas Board's load is spread less evenly than it would probably choose. No less than one-third of the Board's industrial gas load—which accounts for 55% of the total gas sales—goes to an industry which is one of the most sensitive to Governmental, and even international, influences. This is the group of interests comprising the vehicle (and aircraft) makers and their ancillary businesses.

Recent events have demonstrated how decisions made in Westminster can affect production and prosperity in the Midlands. Credit restrictions governing car sales reduced factories to a three-day, and in some cases a two-day, week. During the period October to December, 1960, 23% fewer cars were made in this area—a serious figure by any standard and one which might be expected to inflict a serious blow to gas sales.

But this is the curious thing: Sales of gas to the motor car industry, instead of diving to the same or to a greater degree, fell only fractionally, by 2.4%.

This appears to us to be rather remarkable because although gas carburising plant—which is a significant user of gas—and certain similar equipment cannot readily be let down because two or three days are required to bring it up to operating conditions again, a good deal of the plant employed in motor vehicle manufacture is fast-operating in character; for example, plant for forging, body finishing, etc., could be turned off at almost any time with only a moderate re-heating period.

The moral of the story is a little hard to discern. Perhaps it is that the dangers traditionally associated with putting all one's eggs in one basket do not necessarily befall the gatherer. Be that as it may, motor car manufacture is swinging back to full production—and gas sales are resuming their upward curve.

THE existing airport buildings at Ringway have always been heated by individual gas-fired central heating boilers. In the final stage of the new terminal, which is now being erected, there will be a central boiler house which will serve the heating requirements of the entire building.

By courtesy of The Guardian, Manchester

The new air terminal building at Ringway, Manchester.

HEATING MANCHESTER AIRPORT EXTENSION

By GEORGE HOLMES,

TECHNICAL ASSISTANT, MANCHESTER GROUP, NORTH WESTERN GAS BOARD.

From a paper read to the Manchester District, Junior Association of Gas Engineers.

THE new control tower and administration block of the Manchester airport is the first stage of an important development and is now nearing completion.

In accordance with the Manchester Corporation clean air policy, gas was chosen in the initial stages for heating this new block. Not only is gas completely smokeless, but the sulphur content is negligible when compared with most solid and liquid fuels.

Clean air is, of course, of the utmost importance in the vicinity of an airport and atmospheric pollutants of all kinds should be kept to a minimum. As the boilers are initially being housed in the control tower

block, flueing of the waste gases presented a difficult problem.

On the roof of the block is an all-glass observation tower and a radar mast. It was essential that no flue should project above the building to interfere with the vital work of these two functions nor should there be a possibility of the hot waste gases causing any condensation on the glass of the observation windows.

NEW PROBLEM

Consequently, the flue had to discharge horizontally from the side of the building, and from this arose a new problem in that the prevailing wind would cause static conditions in the flue.

While this would not affect the combustion, it was likely that the flue products would be discharged into the boiler house. To overcome these problems, mechanical extraction has been employed.

The flue assembly consists of three 19-in. diameter flues from the heating boilers and one 11-in. diameter flue from the domestic hot water boiler, which are all branched into a short 24-in. collecting flue.

A 24-in. vertical riser then carries the products of combustion to the top of the 110-ft. main structure. At the top of the tower, the products flow round a 90° bend and are discharged from the building in a horizontal direction.

A two-stage extraction fan is fitted on the horizontal leg at the top of the control tower, and this fan, which is rated at 2,750 cu.ft./min., is capable of working against a resistance of 0.558-in. w.g.

An important feature of the fan is that it is designed to eject the products of combustion away from the building in a horizontal direction, against a maximum wind force of 100 m.p.h.

To enable this high discharge velocity to be achieved, it was necessary to reduce the flue diameter from 24-in. to 12-in. between the extraction fan and flue terminal.

The effect of fan failure was important as there was no provision for automatic cut-off fitted in the gas supply. A test was carried out by checking the flue pull with the fan on and with the fan switched off.

DRAUGHT EFFECT

A negligible difference was noticed and it was realised that the natural draught effect of the flue was sufficient to evacuate the products of combustion from the boiler. The fan was merely accelerating the products at the terminal.

The central heating system is supplied by three vertical Cochran-Kirke No. 10D. Sinuflo hot water boilers, each having a rating of 1.615 mill. B.t.u. per hour.

Additional to this direct potential heat input to the water, there is a certain amount of heat recovery by the water from the heat exchangers of the air conditioning plant.

The domestic hot water is supplied by a Cochran-Kirke boiler with a rating of 485,000 B.t.u. per hour on a separate indirect system using a calorifier in the 800-gal. hot water storage tank.

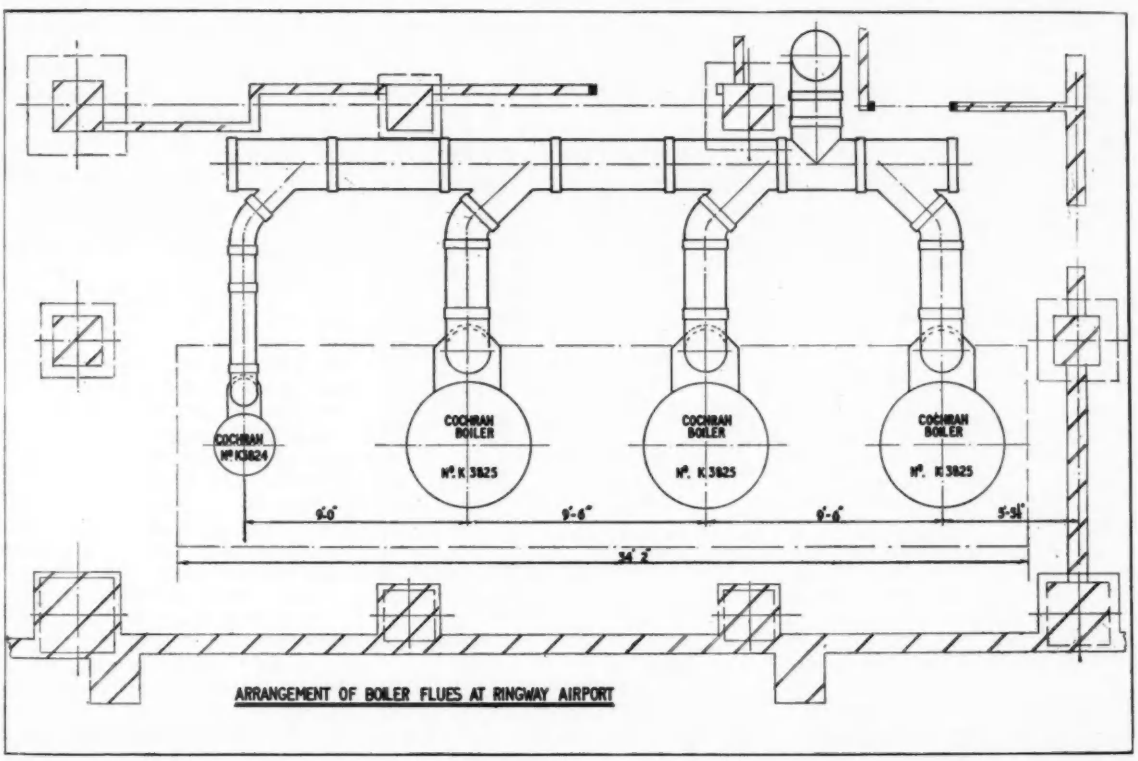
THE BOILER

The vertical Cochran-Kirke Sinuflo boiler consists of a number of waved tubes passing up through the water space of the vessel into a collecting flue in the top of the boiler casing.

The burners are calibrated jets mounted on a manifold. In turn the manifold is mounted on a swivel joint in the gas supply pipe and can be pulled out from underneath the boiler for lighting purposes.

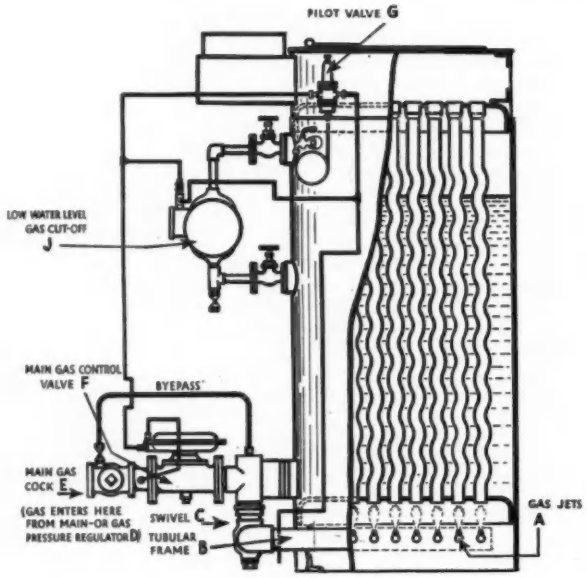
A feature of this attachment is that when the manifold is pulled out only sufficient gas passes to light the burners, but when it is pushed back into its correct firing position, the full gas rate is admitted.

Each burner then fires centrally up the waved tube and the waste products pass into the collecting space men-

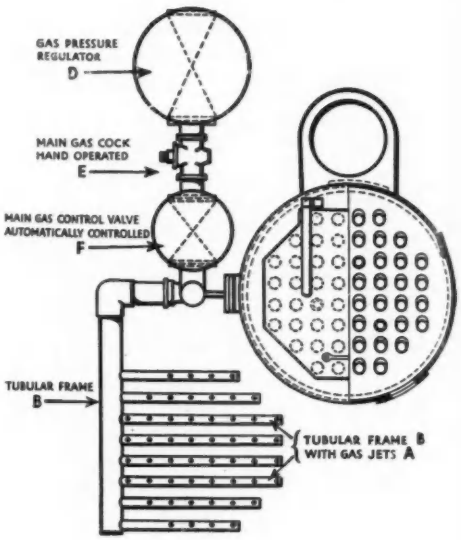


ARRANGEMENT OF BOILER FLUES AT RINGWAY AIRPORT

DIAGRAM ILLUSTRATING METHOD OF BURNING GAS AND APPARATUS USED


PILOT VALVE G
LOW WATER LEVEL GAS CUT-OFF J
MAIN GAS CONTROL VALVE F
BYEPASS
MAIN GAS COCK E
(GAS ENTERS HERE FROM MAIN-OR GAS PRESSURE REGULATOR D)
SWIVEL C
TUBULAR FRAME B
GAS JETS A

ELEVATION.


GAS PRESSURE REGULATOR D
MAIN GAS COCK HAND OPERATED E
MAIN GAS CONTROL VALVE AUTOMATICALLY CONTROLLED F
TUBULAR FRAME B
TUBULAR FRAME B WITH GAS JETS A

PLAN VIEW.

tioned and then into the main flue pipe.

The manufacturers claim that the heat transfer from the hot products of combustion to the water is increased by the shape of the tubes without the use of corebusters or metal spirals.

Due to the products being forced to impinge upon the side of the tube, the static-layer will be reduced and a better transfer of heat will result. Only the basic requirements in gas controls have been fitted to the boilers.

THE CONTROLS

These consist of a Peebles combined pressure governor and low pressure cut-off valve with manual reset, a main control valve with by-pass and a relay valve with weep connection to the hot water thermostat.

As the boiler house is sited in the basement of the building, it was necessary to have an independent supply of air to ensure that there was sufficient available for complete combustion of the town gas in the boilers.

A duct was fitted at high level, to prevent draughts from blowing onto the gas flames, and filtered air now enters the boiler house through registers fitted to this ducting. Due to the difficulties of fixing an effective flame failure device to a multi-hole burner of this type, a 'High-Low' control is used. When the boiler is shut-down by thermostat, the gas pressure merely reduces from $\frac{25}{10}$-in. w.g. to a by-pass rate which throws approximately $\frac{5}{10}$-in. w.g. and the flame changes from a hard semi-aerated flame to a soft, small luminous flame.

The boilers are fitted with draught diverters and are designed to work under natural draught conditions.

Theoretically, the vertical tube boiler does not need a chimney to pull the products of combustion through the boiler as each tube acts as its own chimney and provides sufficient natural draught to evacuate the waste products.

The terminal building had not been completed internally at the time of writing and the total output of 4.850 mill. B.t.u. per hour from the central heating boilers was not required. Consequently, only two of the three boilers had been used up to February.

BAFFLES

Due to the constant passage of workmen through the boiler house, attending to the lighting installations and other constructional work, the doors have not yet been fitted.

As the boilers are opposite the door openings this inconvenience allows draughts to blow directly on to the gas flames.

It is essential that the flames are not displaced from firing into the tubes as this causes flame impingement and bad combustion. Therefore temporary baffles have been placed around the bases of the boilers.

Again, the baffles, if placed too close to the boiler, would prevent a free flow of air to the boiler and cause air starvation in the combustion zone.

RADIATION

The boiler casings and the water circulation pipes are not yet lagged, and consequently there is a high radiation loss from these exposed hot surfaces. This work will be completed in the near future and should have a marked effect on the running cost of the installation.

The hot water is circulated on an accelerated system with electric pumps placed in the return flow pipes. All of the rooms in the control tower and block are heated to temperatures ranging from 55°F. to 65°F., depending upon their functions.

These temperatures are controlled by individual room thermostats operating motorised valves on the hot water flow pipe, thereby giving a good measure of flexibility over the entire building.

The heating system is separated into two zones, i.e., north-east and south-

west. Both zones have an individual outside compensated thermostat or anticipator which operates mixing valves on each of the two zone circuits.

If the temperature should rise, then the anticipator would open the mixing valve and allow part of the cooler return circulation water to by-pass the boiler and thereby cool the flow temperature to the particular zone of the building.

To calculate the efficiency of a boiler, both the input and output ratings should be known. The input is relatively easy to assess but the output is dependent upon factors of radiation from the boiler surface, heat in the water and heat in the flue products which cannot be measured easily.

EFFICIENCY

Therefore, it is usual to base the efficiency of these appliances on the percentage flue loss derived from flue gas analysis and flue gas temperature.

The boilers had been commissioned by the manufacturers and were adjusted to give 9.5% CO_2 in the flue gases. The CO_2 reading had been obtained on a Fyrite instrument which does not give the percentage of oxygen or indicate the presence of CO due to incomplete combustion.

The object of the tests was to obtain a flue gas analysis with a higher CO_2 figure, approaching 12.9% CO_2 (See Appendix 1), (with no CO) and a low flue gas temperature in order to attain the maximum efficiency of the boiler.

It was realised that the flue, being fully open on both the high and the low gas rates, would reduce the efficiency at the 'low' setting due to the volume of excess air being pulled through the boiler by the natural draught effect.

COMPROMISE

Consequently, a compromise had to be found to obtain the maximum overall efficiency where, due to the excess air passing through the boiler, the heat losses did not neutralise the effect of the high efficiency at the maximum rate.

As the damper plate fitted in the down draught diverter was adjustable, it was decided to investigate its effect on the excess air entrained for different areas of damper opening.

To begin with, the damper plate was set in a known position to ensure that excess air would be passing through the boiler.

Flue gas samples were taken, for both the high and the low gas rates, from the primary flue and the flue gas temperature and the velocity of the air passing through the damper were noted.

The damper was then removed, and flue gas samples, temperatures and air speeds were taken.

RESULTS: Maximum gas rate = 4,486 cu.ft. per hour. By-pass rate = 629 cu.ft. per hour.

	CO_2%	O_2%	CO%	Flue Gas Temperature °C	Air Velocity	Flue Loss %
No. 1. Air damper opening = 81 sq. ins.						
Boiler Firing	10·3	3·7	—	390	265	27·5
By-pass	1·4	19·0	—	140	163	48
No. 2. Air damper opening = 324 sq. ins. Damper removed.						
Boiler Firing	10·8	2·8	—	360		25·5
By-pass	2·6	17·6	—	135		30

As would be expected, the maximum efficiency is achieved with the air damper removed completely, which is the condition under which the boiler was designed to operate.

It is also of interest to note the relatively small difference in percentage flue loss under full gas rate and by-pass conditions; this would rather substantiate the maker's policy in abandoning the added complication of an automatic damper which they formerly fitted.

As a matter of interest, I understand the makers of the boiler are developing a new package gas-fired boiler.

APPENDIX 1

THEORETICAL REQUIREMENTS: An analysis of the town gas supplied to the particular area was obtained and the theoretical combustion requirements and gas characteristics were calculated as follows:—

	cu. ft.
O_2 required for combustion/cu. ft. gas ..	=0·8304
Air required for combustion/cu. ft. gas ..	=3,954
CO_2 in products of combustion/cu. ft. gas	=0·4936
H_2O in products of combustion/cu. ft. gas	=0·9146
N_2 in products of combustion/cu. ft. gas ..	=3·3136

	B.t.u./ cu. ft.
Gross c.v. of gas	=450·88
Net c.v. of gas	=405·05

The theoretical CO_2 percentage in the flue products taken on a dry basis are therefore

$$\frac{CO_2}{CO_2+N_2} \times 100 = \frac{49{\cdot}36}{3{\cdot}8076} = 12{\cdot}9\%$$

Flue Loss; The amount of heat lost in the flue gases is a combination of the latent heat of the water vapour plus the sensible heat contained in the gas itself.

The percentage flue loss can therefore be calculated from the following expression :—

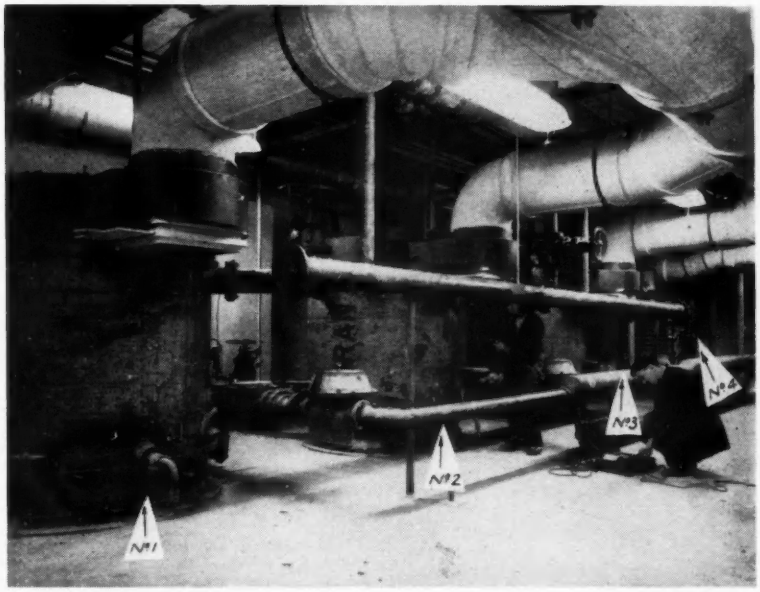
$$\text{Flue Loss } \% = \frac{100}{\text{Gross c.v.}}$$

Gross c.v. — Nett. c.v. + Temp. of gases above ambient temp.

$$\left\{\begin{matrix}\text{Total} \\ \text{volume} \\ \text{waste} \\ \text{gas}\end{matrix}\right. \times \text{Sp. ht.} + \left\{\begin{matrix}\text{Excess} \\ \text{Vol.} \\ \text{Air} \\ \text{Air}\end{matrix}\right. \times \text{Sp. Ht.}$$

Also, the excess air for the above equation, is obtained by substituting in the following expression :—

$$\text{Cu. ft. of excess air per cut. ft. of gas} = \frac{\text{Total } CO_2 \text{ in products per cu. ft. gas} \times 100}{\%\ CO_2 \text{ in actual waste gas} - \text{Total dry products of combustion per cu. ft. gas.}}$$



The boiler house. Nos. 1, 2 and 3 are Cochran Kirke Sinuflo 10D boilers; No. 4, a Cochran 4D.

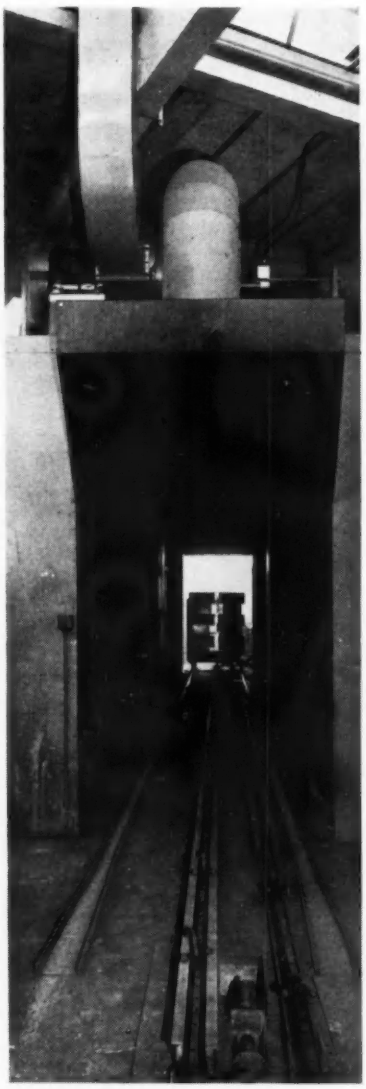
Office equipment output expands —and gas helps

In recent years remarkable changes have taken place in the equipment of offices with such aids to efficiency as electric typewriters, dictaphones, mechanical calculators and even electronic computers being increasingly applied to office routine.

The introduction of this equipment has been accompanied by the development of steel office furniture which, by providing greater strength, longer life, space saving and improved design has contributed a great deal towards the increased efficiency of modern business methods.

One of the best-known manufacturers of steel office furniture is Norwood Steel Equipment Ltd., Howard Way, Harlow, whose range of products includes not only desks, tables, cupboards, lockers, book cases, but wastepaper baskets, filing cabinets and shelves.

It also includes the steel partitioning which is increasingly recognised as the ideal material for interior walls in large modern office buildings.



A Ballard oven, specially constructed to the Norwood Steel Equipment Co. design. Note the method of hauling trolleys of work through this oven.

NORWOOD STEEL EQUIPMENT LTD., which originated in a small factory in Sydenham 13 years ago, now occupies a 5½-acre site in Harlow where the manufacturing area, at present covering 110,000 sq.ft., is to be considerably expanded under the extension plan now in hand. This extension will also mean an increase in the amount of gas the Company takes from the Tottenham Division of the Eastern Gas Board, which at the present time amounts to about 159,800 therms annually.

Gas plays an essential part in the finishing processes, which include degreasing and bonderising prior to spray painting and the subsequent stoving processes. The excellent finish of all its products is a notable feature of Norwood Steel Equipment Ltd., and this testifies to the importance of the heating medium at the finishing stage.

FLEXIBILITY

Among the reasons for the choice of gas as the most suitable fuel for these applications is the fact that it has been found in practice to possess the necessary flexibility and to give the required even temperatures which are so essential for this type of equipment. It also has the cleanliness which is an essential factor in the success of operations of this nature.

Steel sheet of various types is the main raw material of the equipment produced by Norwood Steel Equipment Ltd., and this is fabricated into the required shapes for the different components in the Company's well-equipped workshops.

A very large number of these components, of all shapes and sizes, is produced, including both standard lines and custom-built items specially designed to meet customers' requirements. An idea of the wide variety of components produced can be gained from the fact that the Company produces 70 different types of steel desk.

According to the nature of the end-product, the items arriving at the finishing department are either completely finished, apart from painting, or in the form of single components or sub-assemblies which are assembled or erected after painting.

It is therefore necessary for the plant in the finishing department to be capable of treating components, sub-assemblies and finished items of varying sizes, ranging from quite small pieces to large sections of steel

by

ERIC FORD

With pictures by STEPHEN TENNANT, A.R.P.S., Walter King Ltd.

partitioning. All items, whatever their size, pass through the degreasing and preparation plant and thereafter they are despatched to whichever stoving oven is most suitable for the item in question.

By means of carefully planned conveyor systems and mechanical handling devices, the various pieces, which run into hundreds of thousands annually, are passed quickly through the necessary processes.

All the items arrive at the degreaser suspended on suitable hooks travelling on an overhead conveyor, and are now ready to enter the continuous degreasing and bonderising plant.

This plant occupies one side of a large building and comprises a series of degreasing sprays, the bonderising spray and a drying section. Since the conveyor rail runs at the top of the equipment it can therefore accommodate the largest components requiring treatment

DEGREASING

Manufactured by Modernair Ltd., the degreasing section consists of a number of tanks containing the various solutions which are sprayed from apertures on spray lines fitted vertically up each side of the plant. The degreasing solutions are pumped up these spray lines and the components passing through are thus fully treated all over their surfaces.

These degreasing solutions are contained in five tanks, each 3 ft. by 8 ft. by 3 ft. deep, sited at ground level. Three of them are heated by means of immersion tubes fitted with Aeromatic burners and Perl automatic pilots. Temperatures ranging from 110°F. to 140°F. are automatically controlled by Perl indirect acting thermostats with relay valves.

HOT AIR DRYING

Work emerging from the bonderising section is dried off by means of hot air at 240°F., which is provided by a direct-fired gas/air heater. This appliance is under full automatic ignition and temperature control by a Honeywell Brown instrument.

This degreasing, bonderising and drying plant is an impressive piece of equipment which is entirely automatic in operation. It prepares the metal for painting by leaving a surface which is particularly suitable for the spray painting techniques employed by the Company.

Entry point of the bonderising plant at the Norwood Steel Equipment Ltd. factory. The immersion tube tanks, which are gas-fired, can be clearly seen at ground level.

Large quantities of high quality steel are needed to meet the expanding demand for the products of Norwood Steel Equipment Ltd., Harlow. Shown here is a section of the raw material store.

Office equipment is subjected to considerable handling and other hazards, and the standard of finish required is therefore a high one. For this reason, great care is taken at Norwood Steel Equipment Ltd. to ensure that the metal is properly prepared prior to spray painting.

SPRAY PAINTING

From this section of the works, the prepared components, sub-assemblies and completed items are moved on conveyors to the spray painting areas. The booths are of up-to-date design and fitted with the most convenient types of equipment for the various spray painting procedures necessary.

After spray painting, the components are then moved to the most suitable gas-fired oven for stoving. The painting booths have been carefully sited so that the minimum amount of movement is necessary to pass the items to the appropriate oven. Items are always moved to the most convenient spray booth.

Stoving is clearly a particularly important process when the final finish of the product is as valuable a selling point as it is in the case of office furniture. Careful control of operating temperatures is necessary and this is one of the main reasons why gas has proved the most suitable fuel for this purpose. Stoving times must also be carefully controlled and this is achieved by the continuous equipment in use at Norwood Steel Equipment Ltd.

Included in the stoving equipment is a standard Ballard camel-back oven which is mainly used for stoving sheets of metal required for cupboards, filing cabinets and the like. This equipment has been very well laid out with plenty of room for the service of the oven and ample space at both the entry and exit point.

BUTTON CONTROL

This 40-ft. oven is fitted with Honeywell Brown fully-automatic ignition and control devices operated by press-button. The conveyor comprises an endless series of horizontal rods, fixed between parallel endless conveyor chains, to which items for stoving can be suspended by hooks or in suitable jigs. Hot air circulation is provided by a roof-mounted fan and the firing is by means of a Keith Blackman suction burner.

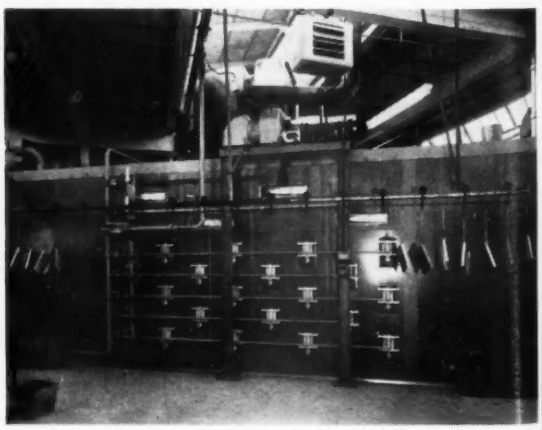
A separate meter on the 3-in. gas supply permits individual gas consumption to be calculated and costings made if required. Operating temperatures are normally in the range of 350° to 360°F.

ON TROLLEYS

Another impressive piece of stoving equipment, also by Ballard, is an oven which was specially built to the requirements of the Company. This is also conveyorised but instead of the endless belt principle of the other oven, the items for stoving pass through the oven on trolleys.

These trolleys run on a specially designed track, the trolleys being engaged by a ratchet which hauls them

A general view of a section of the well-appointed paint stoving shop (left), showing the exit points of the high temperature oven and one of the Ballard ovens. A full load is passing through both ovens. Right: Close-up of the burner arrangements of the high temperature stoving oven.



through the oven on its forward journey but knocks back when encountering any trolleys on the return. Thus a continual succession of ratchets is available to engage fresh trolleys at the entry point of the oven.

Heat for this oven is provided by a direct-fired gas/air heater fitted with a Keith Blackman suction burner mounted on top of the oven from which hot air is blown on to the work trolleys passing through. A hot air curtain is fitted at the entry and exit of the oven, any over-spill of heat being recirculated by a fan fitted to the top of the oven.

Operating temperatures in this oven are of the order of 420°F. and the oven is fitted with an individual check meter and the usual Honeywell Brown automatic ignition and temperature control devices.

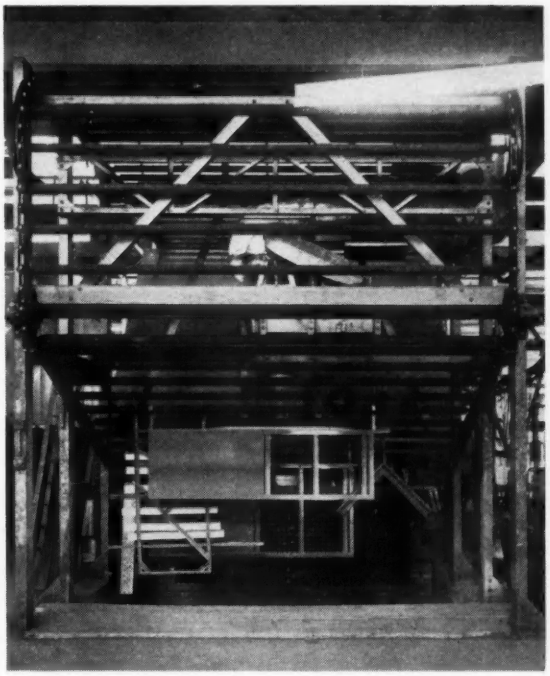
Final assembly operations taking place on yet another piece of Norwood Steel office equipment.

Perhaps the most interesting piece of stoving equipment in the works is the high temperature radiant tunnel which was designed by the engineers of the Eastern Gas Board in close conjunction with Norwood Steel Equipment Ltd. who built the equipment. It is an impressive example of the good results which spring from close co-operation between an enterprising customer and a gas board's industrial department.

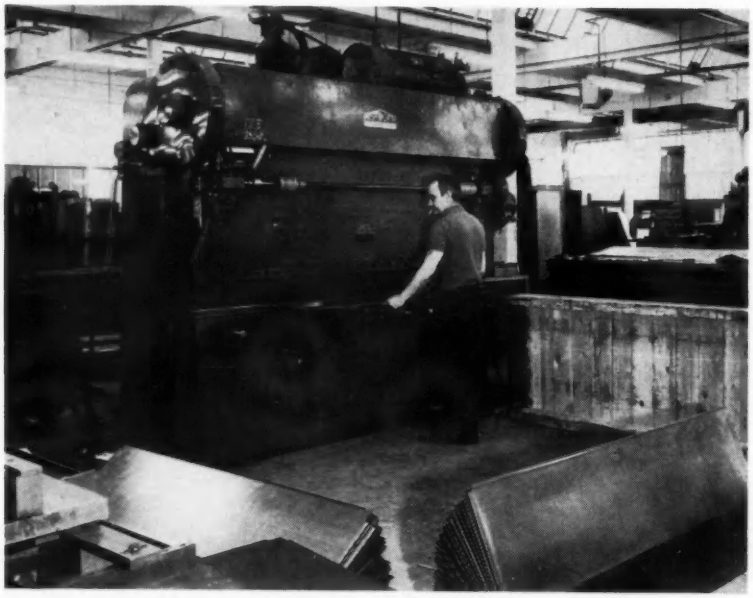
This tunnel is approximately 39 ft. long, 9 ft. high and 4 ft. wide and is served by an overhead conveyor. It is fired by a total of 48 high temperature panels, sited 24 on each side. They are placed in series to give the best results relative to the position of the components passing through the tunnel for stoving. Four panels are supplied from each supply line.

An especially interesting feature of this tunnel is that the Norwood Steel Equipment Ltd. used some of their own products to form the sides of the oven. The steel sheeting incorporated in the manufacture of the tunnel not only gives it a neat and attractive appearance but has proved exceptionally serviceable in practice.

Paint stoving is given particular attention. Gas-fired equipment is intelligently used for this purpose. Here is a Ballard continuous stoving oven.



After fabrication, all the equipment, either complete or in the form of components or sub-assemblies, passes through the gas-fired bonderising plant, a general view of which is shown.



Fabrication of the wide range of equipment takes place in well-equipped workshops. Here is a corner of the press shop.

But the feature of the tunnel which makes it unique is that a recirculating fan has been incorporated to provide an element of recirculating convection to give the most efficient and economical use of gas. It is believed that there are not many examples of this type of equipment in service but the Company reports that the results of this innovation have proved most satisfactory.

VARIATIONS

Great variations in temperature conditions are possible in this oven, which includes a final cold section to allow for 'flash-off'. The hot products are drawn through the top of the oven and down through trunking on either side to enter the oven at the bottom through suitable outlet apertures. It is possible to control the amount of heat emerging from these outlets by dampers fitted to each section of trunking.

UP-TO-DATE

An examination of the varied stoving equipment facilities currently in use at Norwood Steel Equipment Ltd. shows that the Company can meet all the demands made upon it by its many different products. All the equipment is up-to-date, having been installed within the past three years.

The standard Ballard stoving oven has been in use for about three years, the degreasing line for some two years and most of the other equipment for approximately 18 months. The high temperature tunnel has been in operation now for about a year.

This demonstrates the rapid growth of the Company, which, having outgrown its original Sydenham premises and the larger site to which it moved in West Norwood, came to Harlow to occupy temporary premises before moving into the present well-appointed and pleasantly laid out factory in 1955.

The site itself covers 5½ acres and the original manufacturing area, about 100 ft. by 100 ft., has since been extended on three occasions to give the present manufacturing space of 110,000 sq. ft.

EXPANSION PLANS

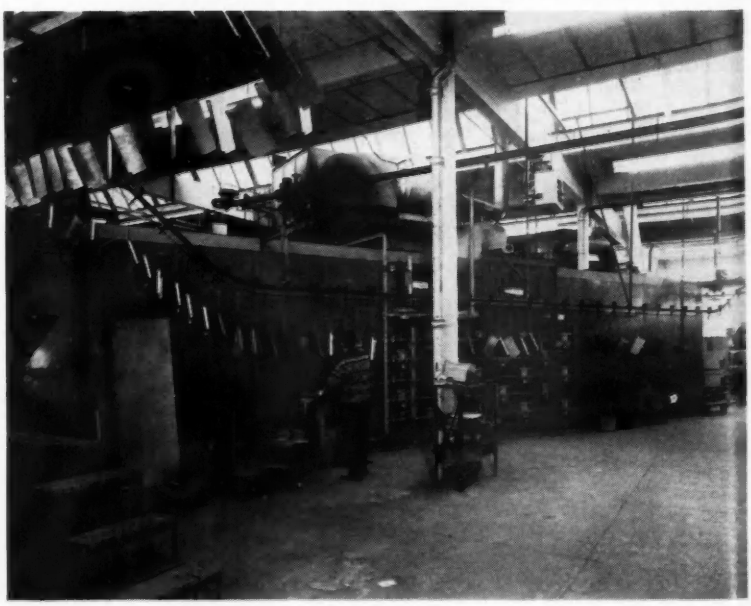
So great is the demand for Norwood steel furniture and office fittings, however, that the present productive capacity is insufficient to meet the needs of customers at home and abroad. Present expansion plans include a further 70,000 sq. ft. expansion of the existing plant, to be completed by the end of the year, with 70,000 sq. ft. more projected over the next three years.

MORE PLANT

These extensions will require a considerable increase in the finishing equipment and it can therefore be supposed that further gas-fired plant will be required in the future, in view of the fact that the present equipment is already being used at or near capacity.

In fact, it is proposed to instal another camel-back oven for stoving purposes, and, in order to gear this into the existing production line, the paint shop area is to be reorganised.

A general view of the high temperature stoving oven, designed and constructed jointly by the Eastern Gas Board and Norwood Steel Equipment Ltd. Among the many interesting features of this oven is the use of the firm's own products to form the sides. The ingenious use the Company makes of mechanical handling methods is also clearly shown in this picture.



Another pre-treatment plant, providing for degreasing, bonderising and drying, will also be required, making still further demands on gas.

When these additions are completed, the entire plant will be operated on the same efficient flow-process lines as at present, with the additional advantages of bigger production runs to make optimum use of the facilities available, including the equipment in the fabricating section and the pre-treatment and stoving equipment in the finishing department.

METERING

Firms which are expanding at this rate, and making the demands on gas supply which is a feature of the expansion of Norwood Steel Equipment Ltd., usually find that service and metering arrangements prove inadequate and have to be revised upwards when new gas-fired equipment is installed.

Although the Company wisely anticipated this situation, and agreed to the laying down of a 6-in. service when the gas supply was first connected, their increasing demand for gas has been so rapid that the Eastern Gas Board is about to install another 6-in. service pipe. The firm's main meter is of 12,000 cu.ft. capacity.

All the gas-fired equipment is being operated at maximum efficiency by the Company and with due regard to its advantages and potentialities. For gas-fired equipment to be used to the very best advantage, however, close co-operation between the customer and the industrial section of the gas supply authority is essential. The industrial gas engineer can prove helpful both during the planning of new equipment, during its installation and at all times during its operation.

A visitor will not have been long on the premises of Norwood Steel Equipment Ltd. before realising that this close and cordial relationship between customer and supplier exists in an unusually high degree.

In fact, the Company pays generous tribute to the officials of the Eastern Gas Board, pointing out that the rapid growth of Norwood Steel Equipment Ltd. has necessitated many alterations to the gas-fired equipment as production has expanded.

'We have at all times been able to rely upon the Eastern Gas Board for speedy attention to demands for alterations and service,' said a Company spokesman.

'Frequently, the growth of the Company has required us to call on the services of the Board at the drop of a hat.'

This is the kind of service any gas board is happy to be in a position to supply, particularly when, as in the case of Norwood Steel Equipment Ltd., the product is in strong demand by Government authorities, municipal undertakings and industrial and commercial firms in all parts of the country.

Flame failure device

TESTS have been carried out on two Radiovisor electronic flame failure devices. On type FR 56/SS, in the event of a flame failure, a change in the bias on the valve results in a break in the circuit supplying the main and pilot gas valves, cutting off all gas to the appliance; the device will now remain at safety lock-out.

If a foreign body having a resistance similar to the pilot flame interferes when starting the appliance, as soon as the valve has warmed up, the indicator lights will turn from red to green, but no action will take place on pressing the start button.—*From Report No. 717/59 of the Industrial Gas Development Committee of the Gas Council (Supplied by Watson House).*

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Modern store uses gas

BUILT on an island site in the centre of Birmingham, Rackhams (Harrods) Ltd., which was officially opened in November, 1960, is the result of many years planning and research. This magnificent new department store towers 150 ft. over Corporation Street, Bull Street and Temple Row.

There are eight floors in the new building, each occupying an area of 55,000 sq.ft.—a further 7,000 sq.ft. a floor will be added within the next few years.

No effort has been spared to make it one of the finest, most modern and comfortable departmental stores in the country.

SPACIOUS

All the spacious and imaginatively designed floors are served by escalators and lifts. Considerable attention has been paid to lighting, heating and air conditioning.

For instance, on the busiest floors the air is completely changed five times every hour in the winter and eight times in the summer.

The hot water system will provide up to 45,000 gal. every day.

RESTAURANT

On the sixth floor are situated a first class, waitress-served restaurant—seating about 400 people; the public cafeteria—catering for about 120; and a staff cafeteria—seating about 300 and expected to serve some 800 to 1,000 staff meals. There is an attractive coffee-bar on the first floor in the Man's Shop.

The kitchen and its departments, which were planned and installed by Benham & Sons Ltd., in close consultation with Mr. Miln, Harrods' Catering Manager, are grouped around the waitress U-shaped service bay with the

These pictures show (top) the still room and pastry service to the sixth floor public restaurant at Rackhams (Harrods) Ltd., Birmingham. Centre: The service counter to the public cafeteria on the sixth floor. There is a refrigerated shelf running down the counter on the right. Below: The main kitchen and service to the public restaurant. Both the upper and lower shelves running down the counter on the right are gas heated.

various sections serving directly on to the 134-ft. run of stainless steel counters.

This, in sequence, is arranged for soiled glass and crockery deposits, cleans racks and shelves, hot service counter for soups, sauces, sweets, vegetables, grills, entrees, meat, fish and pastry, ice cream and tea and coffee service.

It is interesting to note that in 1930 Benham & Sons Ltd. installed a service counter which is still in perfect working condition, measures 157 ft. and is in Harrods' department store in Knightsbridge, London.

CAFETERIA

On the opposite flank of the long kitchen is the 58-ft. long public cafeteria counter served through doorways off the kitchen and by stainless steel refrigerated 'pass through' cabinets opening directly off the larders and salad preparation departments.

The stainless steel counter is fitted with heated and refrigerated sections for hot and cold food and beverages with part refrigerated display and service shelf.

There are also back counter cooking units for 'called-order' items, and a heated cabinet for tea pot warming.

Across the end is the staff cafeteria counter, 38 ft. long and similarly fitted for exactly the same type of service, except that tea is not served in teapots.

This is adjacent to its own wash-up dishwashing machine and stainless steel tabling and sinks.

FOR DRY GOODS

Between the larders and the staff cafeteria are the dry goods stores in which are deep freeze cabinets and two large cold-rooms for general food and meat storage, the vegetable preparation room and the goods receiving department.

At the other end of the kitchen is the main wash-up with its two dishwashing machines having a roller conveyor between for return of trays used through the machine, sinks for washing glasses and cleaning silver, and a silver burnishing machine.

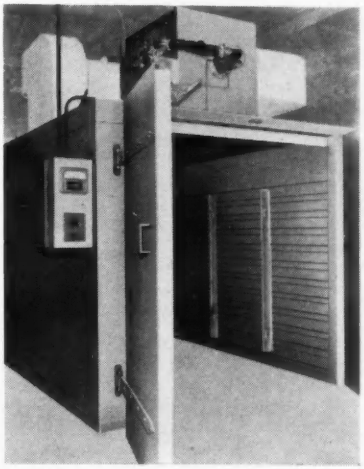
Adjacent to this, and so arranged for service both to the restaurant and the lounge, is the wine dispenser complete with open and refrigerated wine bins, cooled shelves for beer and soft drinks, and an ice-making machine, Formica covered counters and shelves, and stainless steel sinks.

All the cooking apparatus and hot service counters are gas heated and were manufactured by Benhams as were also the stainless steel tables, sinks, and other equipment.

EXTRA AID FOR STOVING, DRYING

NEW SERIES

A direct gas-fired unit from a new series of recirculating ovens by G. & R. Gilbert (Industrial) Ltd., Hackbridge, Wallington, Surrey.



THE range of standard ovens for stoving, drying, curing, pre-heating and baking provided by G. & R. Gilbert (Industrial) Ltd., Hackbridge, Wallington, Surrey, has been increased by the inclusion of a new series of recirculating ovens with three forms of heater, and 36 standard sizes.

The primary advantages of recirculating ovens over other types of batch oven, are floor level loading, without recourse to pits or ramps, more uniform temperature conditions, the ability to handle more densely packed loads without creating cold spots, and in many cases to cut process times by reason of faster heat transfer and quicker removal of solvents and vapours from the working space.

Illustrated is a typical direct gas-fired unit from this range, showing the heater and fan assembly mounted on top of the oven. The arrangement is usually preferred, as it occupies the minimum floor space. Where headroom is limited, however, the heater may be placed at floor level on one side of the oven.

Directly fired ovens have a neat gas burner firing into a stainless steel combustion cylinder mounted in an insulated steel heater body, recirculating air being drawn through the body of the heater mixing with the products of combustion before passing to the oven over a special type of hot gas fan.

Full thermostatic control and safety control are supplied with these ovens as standard equipment.

The sectional construction used enables installation in buildings with restricted access and allows of widths of 5 ft., 6 ft., and 7 ft., heights of 6 ft. 6 in. and 7 ft. 6 in. to be built up in 4 ft., 5 ft., 6 ft., 8 ft., 10 ft. and 12 ft. depths.

Larger ovens can be built up to order.

A flame trap development

A TYPE of flame trap has been developed that will suppress flames flashing back through pipelines containing air/gas mixtures, even those flames travelling at detonation velocity.

It is of vital importance that a good seal be obtained whenever an arrester is inserted in a housing, and that regular maintenance be undertaken, because the trap may become damaged by explosions or blocked by carbon deposited when flames are extinguished. If a flame is arrested, but not extinguished, the fuel supply must be stopped before the arrester is heated sufficiently to ignite mixture upstream.

Although efficient flame traps are effective at any position in pipelines, it is advisable to insert the traps as near the burners as possible. A flame flashing back from a burner starts at a relatively low speed and then accelerates along the pipe and can under certain circumstances reach detonation velocity.

By positioning the trap close to the burner, it need not be exposed to the severe conditions of detonation and so its life can be increased. Also, when a detonation is arrested, a pressure pulse travels past the trap and could damage ancillary devices.—*From Report No 731/60 of the Industrial Gas Development Committee of the Gas Council (Supplied by the Midlands Research Station).*

LOOKING AROUND

Vitreous enamelling

AN examination into vitreous enamelling in open-fired furnaces was recently carried out.

Among the conclusions reached was that satisfactory enamelling of delicate colours could be continuously achieved in an open town gas-fired furnace with local dilution of products of combustion to a carbon dioxide concentration of 1% or less.

The use of an under-fired furnace with combustion conditions set to give maximum heat transfer around the working chamber appeared to be necessary, as was a ventilated arch to give maximum scrubbing effect of the gases and at the same time a minimum resistance to flow and avoidance of turbulence.

Also necessary were a suitable recuperator in the out-going products stream to produce pre-heated air for purging, and a perforated working hearth permitting the passage of hot air for dilution at low velocity.—*From Report* 732/60 *of the Industrial Gas Development Committee of the Gas Council* (*Supplied by the West Midlands Gas Board*).

★

Cross lighting

CROSS lighting distances between Bray No. 266 industrial jets and Bray No. 118 miniature jets, which are mainly used in bar burners, depends upon a number of factors. With an increase in the size of jet and burner pressure, the maximum permissible spacings for jets to cross light increases. The cross lighting distances of hot jets is approximately 85% of the distances for jets that have been lit up from cold ; this is probably mainly due to the reduction in gas rate through the hot jets.

Cross lighting distances are a maximum for flames arranged in line and a minimum for flames arranged in parallel. With increases in specific gravity of the gas, the maximum cross lighting distances between jets decreases; distances for a G.7 gas are approximately 80% of those for a G.4 gas.—*From Report* 708/59 *of the Industrial Gas Development Committee of the Gas Council* (*Supplied by Watson House*).

★

The 'Oxycat' unit

PLANT has recently been installed at the premises of Morphy Richards Ltd., St. Mary Cray, Kent, for pretreatment, spraying and stoving. Heat is supplied by direct gas-fired air heaters, supplemented, on the paint stoving section, by an 'Oxycat' unit.

Tests carried out on the 'Oxycat' unit, showed that the volume of air handled by the heater and the unit is approximately 189,000 cu. ft. per hour. The heat input due to combustion of gas is 1.02 mill. B.t.u. per hour, and additional heat due to combustion of solvent vapours in the 'Oxycat' unit is 228,400 B.t.u. per hour. As a consequence, 245,000 B.t.u. have been saved as it is no longer necessary to discharge 10% of the heated air to atmosphere.—*From Report No.* 725/60 *of the Industrial Gas Development Committee of the Gas Council* (*Supplied by the North Thames and South Eastern Gas Boards*).

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Glass fusing

DIFFICULTIES have for some time been experienced in the fusing of glass used in electric lamps, especially blacking, under-melting and reduced production speed caused by wide variations in flame character within a short time.

Investigations showed that it was impossible to maintain a stable flame when the air/gas ratio rose above 3:1 on a 500 Wobbe number gas. A 4:0 air/gas ratio appeared to be the minimum figure at which satisfactory results could be obtained without blacking taking place.

It was suggested that the burners should be modified to give a 200% increase in flame port area and be used in conjunction with the Sigma-Kent Wobbe controller—*From Report No.* 710/59 *of the Industrial Gas Development Committee of the Gas Council* (*Supplied by the Eastern Gas Board*).

★

Burner control

THE Flamemaster Series II automatic gas burner control is an electronic flame failure and ignition device using flame conductivity as the means of sensing the presence of the flame at the burner of the appliance. Should flame failure occur, all gas is cut off from the appliance and an alarm circuit closed sounding a warning to the operator.

The device is a versatile unit which can be adapted to suit most installations.—*From Report No.* 728/60 *of the Industrial Gas Development Committee of the Gas Council* (*Supplied by the Watson House Research Centre*).

★

Explosion reliefs

EXPLOSION reliefs should be inserted into all industrial ovens. If shelves are used, the relief must be at the back and must occupy the whole of the back of the oven. If the load is suspended from the top of the oven, the relief should be at the back, but may be in the top providing the area available for the relief at least equals the area of the back of the oven.

The only case when a top relief is necessary is when the load consists of sheets suspended parallel to the door and substantially covering the cross-section of the oven.—*From Report No.* 707/59 *of the Industrial Gas Development Committee of the Gas Council* (*Supplied by the Midlands Research Station*).